

# NASA TECH BRIEF



NASA Tech Briefs are issued by the Technology Utilization Division to summarize specific technical innovations derived from the space program. Copies are available to the public from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia, 22151.

## Test Strips Detect Different CO<sub>2</sub> Concentrations in Closed Compartments

**The problem:** To devise test strips that will give unambiguous colorimetric indications of four different concentrations of carbon dioxide in the atmosphere of a closed compartment. Test strips containing the dye crystal violet (methyl violet) which has been reduced to a colorless form by hydrazine have previously been used to provide colorimetric indications of two different concentrations of carbon dioxide. Although a number of test strips prepared with different proportions of crystal violet and hydrazine can be used for detection of higher carbon dioxide concentrations, the changes from the colorless dye form to several different shades of blue-violet corresponding to discrete concentrations of the gas are not sufficiently distinct for comparative purposes. In addition, the hydrazine used as a decolorizing agent for the dye has a relatively high vapor pressure and produces toxic vapors at and above room temperature. Test strips prepared with this agent would therefore present a health hazard to individuals in small closed compartments.

**The solution:** Prepare four different test strips, using crystal violet for one pair of strips and basic fuchsin as a dye for the second pair of strips. Tetraethylene pentamine, which has a relatively low vapor pressure and is nontoxic, is used in place of hydrazine as a dye decolorizing agent.

**How it's done:** Four different dilute solutions using ethylene glycol as a solvent for the dyes and the tetraethylene pentamine decolorizing agent are prepared. Two of the solutions are made with different proportions of crystal violet and decolorizing agent, and the other two solutions are made with different proportions of basic fuchsin and decolorizing agent. Test strips consisting of white absorbent paper are

then separately saturated with the colorless dye solutions and allowed to dry. The four sets of test strips thus produced will undergo distinct color changes in response to four discrete concentrations of carbon dioxide. One set of crystal violet paper will change from white to blue-violet when exposed to atmospheres in which the partial pressure of the carbon dioxide is equal to or greater than 2 mm of mercury and the other set of crystal violet paper will provide this color indication when the carbon dioxide partial pressure reaches 4 mm of mercury. One set of basic fuchsin paper will change from white to red when the partial pressure of the carbon dioxide reaches 6 mm of mercury, and the other set of basic fuchsin paper will undergo this color change at a carbon dioxide partial pressure of 8 mm of mercury.

### Notes:

1. The test papers should prove useful for rapid colorimetric detection of undesirable concentration of carbon dioxide in closed compartments and sealed laboratory apparatus.
2. Inquiries concerning this invention may be directed to:

Technology Utilization Officer  
Manned Spacecraft Center  
P.O. Box 1537  
Houston, Texas, 77001  
Reference: B65-10390

**Patent status:** NASA encourages the immediate commercial use of this invention. It is owned by NASA and inquiries about obtaining royalty-free rights for its commercial use may be made to NASA, Code AGP, Washington, D.C., 20546.

Source: Melpar, Inc. under contract  
to Manned Spacecraft Center  
(MSC-210)

Categories 03, 04